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THESIS

**WAR IN THE ATLANTIC: A HISTORICAL CASE OF
HOMELAND SECURITY**

by

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September 2015

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**WAR IN THE ATLANTIC: A HISTORICAL CASE
OF HOMELAND SECURITY**

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ABSTRACT

At the outbreak of World War II, Great Britain was unprepared to counter German submarine warfare in the Atlantic. In World War I, Germany had conducted a devastating U-boat campaign against merchant shipping, threatening the Atlantic supply chain that Britain depended on for goods, food, and materiel. The Royal Navy defended the commercial fleet by organizing convoy escorts. In the interwar period, the navy was burdened by a poor economy, interservice rivalry, and a treaty limiting its fleet.

Historian Correlli Barnett points out that the admiralty had warned that the diminished navy was unprepared to face the rising aggression of Japan and Germany in his book *Engage the Enemy More Closely*, published in 1991 by Norton. When war was declared, the navy immediately resumed the convoys and escorts, but it was not sufficient to protect all routes.

In the end, technological advances, above all the introduction of long-range aircraft in an antisubmarine role, helped offset British unreadiness and concomitant losses in the Atlantic, but ingenuity would not have been enough. Without strategic alliances, Britain could not have gained the upper hand.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASV	air-to-surface vessel
ASW	antisubmarine warfare
ASDIC	Anti-Submarine Detection Committee
COS	Chief of Staff Committee
CID	Committee of Imperial Defense
CVE	escort aircraft carriers
Huff-Duff	high-frequency direction-finding
TBS	talk between ships (high-frequency radio telephone)
VLR	very long range
RAF	Royal Air Force

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I. BRITISH SHIPPING LOSSES: HISTORICAL CONTEXT

At the outbreak of World War II, Great Britain was unprepared to counter German submarine warfare in the Atlantic. Necessity ultimately impelled the British to rely on aircraft to protect shipping and repel German U-boats, but this innovation came late in the war. Despite the gravity of the U-boat threat, Britain initially allocated its small inventory of long-range aircraft to strategic bombing rather than the defense of vital supply lines across the Atlantic. This thesis examines British resistance to the use of aircraft in the Atlantic antisubmarine campaign of World War II.

A. UNRESTRICTED SUBMARINE WARFARE

Britain's experience with U-boats in World War I directly informed its antisubmarine strategies in World War II. Although the German navy was not as large as the British navy, it included *Unterseeboote* (U-boats), which proved highly effective against merchant shipping. As an island nation, Britain relied on supplies from around the globe to maintain itself; thus, the German use of U-boats to shut down material and food imports and starve Britain into capitulation was a real threat.

By mid-1916, the French, German, and British armies were entrenched in a battle line that cut across Europe. Germany had suffered tremendous casualties and was feeling the strain of sustaining two fronts under an Allied naval blockade that created shortages of raw materials and compromised the nation's ability to produce munitions.¹

German military leaders met in late August 1916 to discuss new ways to defeat the Allied forces, and Admiral Henning von Holtendorff presented a paper calling for renewed, unrestricted attacks on British commercial shipping, including neutral vessels bound for British ports.² Holtendorff calculated that an unrestricted U-boat campaign that could sink a minimum of 600,000 tons a month, could force the British to buckle to German demands.³ Holtendorff estimated that the Great Britain's population consumed

¹ John Terraine, *The U-Boat Wars 1916–1945* (New York, G.P. Putnam's Sons, 1989), 4.

² *Ibid.*, 12

³ V. E. Tarrant, *The U-Boat Offensive 1914–1945*, (Annapolis: Naval Institute Press, 1989), 44.

10.75 million tons of food a month; by enforcing a monthly deficit of 600,000 tons for at least five months, Germany could reduce shipping to Great Britain by thirty-nine percent, which he estimated would be too great a strain for the population to endure.⁴

Holtzendorff's call for unrestricted attacks on merchant shipping was part of an overall goal of forcing Britain to negotiate peace before the harvest of 1917.⁵ Suffering under the naval blockade, Germany needed resolution before it was placed in a position where it could no longer support its armies. German leadership had recognized that France and Italy were so dependent on British economic support that, if Britain fell, the remaining Allies would collapse or be forced to negotiate on Germany's terms.

At the beginning of the war, the German navy used U-boats in an attempt to counter-blockade Britain. Customary rules for conducting a naval blockade depended on tradition, rather than law, and militaries generally conformed to a set of conventional practices.⁶ Launching a surprise attack against a warship was viewed, by most world powers, as a legitimate act of war; a surprise attack against a merchant ship, however, was an uncustomary violation of civilized norms. Since the age of sail, it was understood by most maritime nations that warships would inform an intercepted vessel that it would be boarded, and attacked if it resisted. The boarding crew would inspect any cargo to determine if it were contraband and, if so, the cargo and vessel would be seized.

Germany's submarines, however, did not carry boarding crews. Instead, they ordered the merchant crew to their lifeboats and sank the parent vessel.⁷ In their defense, merchant vessels began to arm themselves, and this, in turn, led to U-boats attacking merchantmen without warning. Such aggression was perceived as an appalling outrage, and the Germans drew international condemnation. Despite the backlash, Germany pronounced on February 4, 1915, that the waters around Great Britain and Ireland were a war zone, that intercepted merchant vessels would be sunk, and that neutral vessels were

⁴ Tarrant, *The U-Boat Offensive*, 44.

⁵ Terraine, *The U-Boat Wars*, 15.

⁶ *Ibid.*, 5.

⁷ *Ibid.*, 7.

not guaranteed safe passage.⁸ While U-boat commanders were instructed to spare neutral shipping, their first consideration was the U-boat and its crew, and the commander would not be held accountable for mistakes.⁹

One of the first casualties of this policy was the sinking of the liner RMS *Lusitania*, which, in addition to 1,957 passengers, was transporting field artillery, ammunition, and percussion fuses from New York to Liverpool.¹⁰ The destruction of the *Lusitania*, accompanied by the loss of 124 American lives, aroused the ire of the United States, a consequence ultimately detrimental to Germany.¹¹ By the end of 1915, the small U-boat fleet had sunk 1,307,996 tons of shipping, of which 855,729 tons were British.¹²

In March 1916, the German navy deployed greater numbers of U-boats. Later that month, the passenger ferry SS *Sussex* was sunk in the English Channel, which resulted in the deaths of more Americans. The United States responded with an ultimatum demanding an end to the intensified U-boat campaign. Germany initially acquiesced, wishing to avoid hostilities with the United States. U-boat commanders were ordered to board and search vessels before sinking them.¹³

Five months later, in August 1916, Holtzendorff proposed a renewed effort to cut Britain's supply chain. To maximize destruction, he proposed that warnings to merchant ships be eliminated.¹⁴ This was part of what was meant by "unrestricted" submarine warfare: warfare without regard for the lives of merchant seamen or the rights of neutrals. Holtzendorff discounted the threat of the United States declaring war, believing it would take considerable time before America could do any harm. Meanwhile Britain was already straining to maintain its war effort. Holtzendorff concluded that immediate

⁸ Terraine, *The U-Boat Wars*, 9.

⁹ Ibid.

¹⁰ Ibid., 11.

¹¹ Ibid., 10.

¹² Ibid., 18.

¹³ Ibid., 11.

¹⁴ Ibid., 14.

pressure on Britain's supply chain would force a peace negotiation.¹⁵ The leadership of the German army was fractured by Holtzendorff's plan, and the decision was postponed. In September, after a visit to the western front and a meeting with commanders, Field Marshal Paul von Hindenburg, chief of staff of the German army, and General Erich von Ludendorff, his deputy, agreed to Holtzendorff's plan.¹⁶

B. ECONOMIC WARFARE

Germany sank 355,139 tons in December 1916, of which 182,292 were British and the remainder neutral. February 1917, the first month of the unrestricted campaign, yielded 520,412 tons; March and April also saw a jump, finally meeting the 600,000 tons called for by Holtzendorff. May, June, and July were equally successful.¹⁷

Germany fielded 105 active U-boats on February 1, 1917: forty-six posted to the North Sea, twenty-three to the Flanders flotillas and the remainder scattered throughout the Adriatic and Baltic and at Constantinople.¹⁸ These U-boats were a novel weapon. Although the first commissioned submarine was launched at the turn of the century, submersibles had not been employed in a large-scale campaign. Germany's first experimental U-boat was tested in 1907, and the first model capable of crossing open ocean was not available until 1913, which meant that this form of naval warfare was largely prototypical. British naval leadership was uncertain as to the capabilities of the U-boat fleet. Germany had quickly developed improvements and variants, each with greater speed, armaments, range, and diving capacity. Those produced in the latter part of 1916 carried twelve torpedoes, traveled at peak speeds of 16.5 knots on the surface and 8.2 knots submerged, and had an endurance of 4,080 miles.¹⁹

The carnage inflicted on merchant shipping in 1917 drove the admiralty to desperation. Extrapolating from losses recorded in April, when 860,334 tons were sunk,

¹⁵ Terraine, *The U-Boat Wars*, 15.

¹⁶ Ibid.

¹⁷ Tarrant, *The U-Boat Offensive*, 47, 53.

¹⁸ Ibid., 46.

¹⁹ Terraine, *The U-Boat Wars*, 21.

the British predicted a reduction in shipping from 8,394,000 tons to 4,812,000 tons by the end of the year.²⁰ Meanwhile the government stopped reporting shipping losses to the public.

By the end of April, Britain only had six weeks of grain supplies left.²¹ Admiral Sir John Jellicoe, commander of the Royal Navy, saw no clear solution.²² Minefields had been tried, but U-boats passed through early installations with few losses. Early mine designs were flawed and of 20,000 mines deployed, it is estimated that only 1,500 actually detonated.²³ The admiralty pressed the United States for replacement ships to offset losses, and British production of merchant ships increased, but the steel vital for their construction had to be allocated from stores intended for warships.²⁴ 1,163,000 tons of new shipping was produced in 1917, which replaced only a quarter of the annual loss of 4,010,000 tons.²⁵

C. DESPERATION

After the frenzy of depredations from February–April 1917, the number of deployable U-boats diminished slightly in May, which led to an immediate decrease in losses.²⁶ At the same time, the admiralty experimented with organizing merchant ships into convoys and providing them with escorts for protection, which would eventually provide substantial relief.

Naval leadership had previously evaluated convoys as a solution and concluded they would not work. In January 1917, the operations department published a report concluding that grouping merchantmen as a convoy would only present a greater abundance of targets.²⁷ Rear Admiral A.L. Duff argued that convoys would be

²⁰ Terraine, *The U-Boat Wars*, 47.

²¹ *Ibid.*, 48.

²² Tarrant, *The U-Boat Offensive*, 50.

²³ Terraine, *The U-Boat Wars*, 34.

²⁴ Tarrant, *The U-Boat Offensive*, 50.

²⁵ *Ibid.*, 50.

²⁶ *Ibid.*, 47.

²⁷ Terraine, *The U-Boat Wars*, 52.

handicapped by the slowest vessel in the group and the failures of constituent vessels to hold their positions.²⁸ By late April, however, Duff and Jellicoe were desperate enough to try. The first convoy, sailing in May, was successful; sixteen merchant ships escorted by six destroyers and a flying boat completed their voyage without loss.²⁹

Convoys were by no means a new concept; the practice was common throughout the nineteenth century, and, serving as a contemporaneous example, in 1916 the French admiralty had instituted “controlled sailings” to protect coal shipments to France.³⁰

After the success of the trial convoy, the admiralty organized a convoy committee to analyze the possibilities of heavier deployment. Their report served as a strategic framework for the remainder of the war and the starting point for convoy planning in World War II.³¹ The navy proceeded with regular convoys from then on.

Nevertheless, shipping losses in June were second only to April, as kinks in the new system were worked out. Meanwhile, although the strategy of unrestricted attacks was causing greater attrition than Allied construction could replace, the German command realized that a peace agreement by August was unrealistic under present conditions. Stepping up the attack, its navy ordered ninety-five new U-boats, to be launched by the summer of 1918.³²

In examining the merits of convoys, the admiralty recognized that they would necessarily complicate operations in British ports. Organizing mixed flotillas to depart and arrive as a unit took time and added congestion and confusion, which increased shipping costs. The staggering toll of the “unrestricted” campaign, amplified by rising numbers of neutral vessels that ceased to operate, given the risk, far outweighed the expense of convoys. As shipping attrition began to foreclose Britain’s ability to fight the war, the costs of the convoy system became acceptable.

²⁸ Tarrant, *The U-Boat Offensive*, 51.

²⁹ Terraine, *The U-Boat Wars*, 60.

³⁰ Tarrant, *The U-Boat Offensive*, 51.

³¹ Terraine, *The U-Boat Wars*, 62.

³² Tarrant, *The U-Boat Offensive*, 54.

D. SOLUTIONS

The convoys worked—for unexpected reasons. The Royal Navy had feared that clusters of ships would provide easy targets, but the effect was the opposite. In the vastness of the Atlantic, a convoy had a much better chance of slipping through unsighted than the alternative of hundreds of constituent ships sailing independently. Moreover, the escorting warships could take the offensive if a U-boat were sighted. Previous hunting groups had failed to sink or damage a U-boat, partly because of the time it took a warship to respond to a report of targets location. A tight convoy guaranteed substantially less delay from sighting to attack.³³

Initially, convoys were arranged for ships inbound to Great Britain only, as the most pressing need was for supplies from abroad. Adjusting their strategy after enjoying fewer hits in July, however, U-boats began attacking outward-bound ships, which had been sailing without escort. By August, the convoy committee countered by adding protections for outbound shipping. Merchantmen were escorted beyond the most dangerous seas, upon which the escort would detach and rendezvous with an inbound group. This maximized the on-duty performance of escort ships and enabled more merchant vessels to be protected through convoy. The result was more complete coverage and reduced merchant losses; it forced the U-boats to adopt a different tactic.³⁴

U-boats, unable to find targets in the approach corridors to Britain, began to hunt in the Irish Sea, English Channel, and coastal waters. Within ten miles of the British Isles, ships continued to sail independently, and it was these ships that the U-boats focused on from October to December 1917. Again, the Admiralty had failed to arrange for convoys in these areas, which accounts for the majority (58 percent) of the losses incurred in this period.³⁵ Despite these losses, on the whole, the convoy system was proving effective and the monthly totals of losses continued to decrease. The shift to

³³ Terraine, *The U-Boat Wars*, 55.

³⁴ Tarrant, *The U-Boat Offensive*, 55.

³⁵ *Ibid.*, 56.

coastal waters also resulted in fewer larger ships being sunk; most of the coastal shipping was conducted with smaller vessels.

As merchantman sinkings decreased, the Germans ordered another 108 U-boats, to be completed in 1919. U-boat losses had climbed due, to the use of a new British mine. Thirty-seven U-boats were destroyed by the end of 1918—only slightly less than the commissioning rate that year.³⁶

One key advantage of the Royal Navy was its ability to exploit German radio transmissions. The office of the director of naval intelligence, organized in 1914, was able to decode any German transmission, and another group used bearings from radio transmissions to locate German warships as of 1915.³⁷

In May 1918, ministry of shipping official Sir Leo Chiozza Money made the startling discovery that, at minimum, Great Britain would need 4,812,000 tons of shipping for importing food. In April 1917, Britain had 8,394,000 tons available; however, by January 1918, the merchant marine had lost 2,909,155 tons. New ships delivered during that period left 6,401,845 tons remaining. Of this amount, 925,000 tons had been damaged and would be unavailable for up to six months while under repair.³⁸ Only 5,47,845 tons was available for transportation of goods, which, compared with the minimum figure calculated by Money, meant only 664,845 tons of surplus shipping available. This total, compared against the losses incurred in the spring and summer, corresponded to a single month's average losses. Britain's shipping was arriving at the very brink of failure.³⁹

It is important to consider how much loss was specifically British. Initial reports by German naval staff neglected to consider the effects of neutral shipping. Holtzendorff's plan assumed that neutral shipping would stop and that destroying 600,000 tons of British shipping a month would force peace talks. The U-boat fleet

³⁶ Tarrant, *The U-Boat Offensive*, 59.

³⁷ Terraine, *The U-Boat Wars*, 31.

³⁸ Tarrant, *The U-Boat Offensive*, 59.

³⁹ Ibid.

performed as tasked, meeting the average quota set out in the plan, but neutral shipping did not cease; it was reduced by only twenty percent, which meant that of the 600,000 tons sunk per month, only 400,000 was British. While this caused severe material shortages for the British, it did not achieve the annual depletion of 3,250,000 tons that Holtzendorff assumed.⁴⁰

With the convoy system firmly in place by the beginning of 1918, maritime shipping began to suffer fewer losses. The admiralty however, saw the convoy system as merely defensive, and sought offensive action as well. Consequently, the navy began two large mining operations in 1918. The first minefield, laid across the Strait of Dover, destroyed twelve U-boats that were attempting traversal. U-boats were forced to use a northern route to reach their patrolling areas on the western approaches, adding substantial delay to their transit.⁴¹

The second field was laid across the northern transit zone between the Orkney Islands and Norway. This minefield was unsuccessful, largely because the ocean is much deeper in this area (up to 900 feet), which allowed the U-boats to dive below, and the fields spanned a much wider area (254 miles).⁴² Laying these minefields was tasked to some of the Navy's fastest destroyers, which had been employed in escorting convoys; therefore, the pursuit of mining operations reduced the security of the merchant marine.

The admiralty perception of the convoy system as primarily defensive failed to understand how the convoy system increased the offensive abilities of warships by concentrating them in the areas likely to experience U-boat action. Though convoy escorts destroyed only twelve U-boats from August–October 1918, there is no question that they were effective. Only ninety-six convoyed ships were sunk in World War I—a mere 0.60 percent of the 16,070 ships that sailed in open-ocean convoys.⁴³

⁴⁰ Tarrant, *The U-Boat Offensive*, 54.

⁴¹ *Ibid.*, 61–2.

⁴² *Ibid.*, 62.

⁴³ *Ibid.*, 66–7.

The Royal Navy had struggled during World War I with senior leadership that managed every detail of the fleet, rather than conferring with staff to determine best courses of action. Winston Churchill initiated the first naval staff in the Royal Navy before leaving the position of first lord of the admiralty. By the end of World War I, naval staff had begun managing the fleet and allocating more responsibility to unit commanders. The shift to a naval staff also provided a way for younger leaders to present different solutions to problems, rather than abide by traditional assumptions. Adaptation was crucial to overcoming the new problems posed by U-boats.

The most important dynamic of ocean convoys and, later, coastal convoys, was that they deprived U-boats of opportunities to attack. When a U-boat sighted a convoy—which became more and more difficult—it had to position for attack without being detected by the escorts. This often forced the U-boat to remain submerged and travel at a slower maximum speed, so it could not keep up with the convoy. When a U-boat did attack, it often could do so only once before falling out of range or having to take evasive action.⁴⁴

The U-boats failed to adapt successfully to the convoy system and maintain their rate of shipping takes. Powerless to force peace negotiations or prevent American troops and materiel from reaching Allied forces, the German navy was unable to win the war. The deprivation visited by the naval blockade and casualties sustained in nearly four years of fighting led the German population to civil revolt. Kaiser Wilhelm gave the people a new chancellor who, on October 5, 1918, asked President Wilson for an armistice. Negotiations dragged on for a month before the Treaty of Versailles was signed on November 11, 1918, ending the conflict.⁴⁵

E. THE ADVENT OF AIRCRAFT

The Royal Navy expended vast government funds in World War I, yet nearly failed in defending maritime shipping. Nor had the navy won any decisive victories; the Battle of Jutland, for example, the largest naval battle of the war, was an inclusive

⁴⁴ Tarrant, *The U-Boat Offensive*, 67.

⁴⁵ *Ibid.*, 72.

engagement that left the Royal Navy more damaged than the Germans.⁴⁶ Although the blockade against Germany led to shortages and hardships for the German public, and ultimately, a revolt that helped bring about the armistice, it had taken four years to produce an effect. This slow, protracted strategy, coupled with a lack of decisive victories and high costs, led many in the British government to look beyond the navy for new means of conducting economic warfare. The use of aircraft in the war had sparked innovation and created a new realm of combat that would challenge the dominance of the Royal Navy.

Aircraft in World War I were initially flown as an observation and reconnaissance platform, although their use quickly expanded. As early as 1911, aircraft were evaluated for their ability to detect submarines;⁴⁷ they were put to the test in September 1916, when a pair of Austro-Hungarian Lohner flying boats spotted a submerged French submarine in the Adriatic. The aircraft made a series of attacks from 600 feet, dropping bombs that damaged and immobilized the vessel. Unable to escape, the submarine commander ordered his crew to evacuate and scuttled the craft.⁴⁸

The U-boat's greatest asset was its ability to evade detection, but it was limited in speed and endurance while submerged. Unless a commander needed to maintain concealment, transiting was done at the surface to make greater speed and conserve batteries. Aircraft proved well suited to patrolling for U-boats, with much greater speed than surface vessels and an ability to scan a much larger swath of ocean.

U-boats hulls in World War I were 11–16 mm thick; the small bombs carried by aircraft could only cause serious damage by striking the U-boat directly. Aircraft usually did not carry radios, which prevented them from relaying information about a detected U-boat in a timely fashion. Near the end of the war, however, British aircraft compensated by organizing “scarecrow” flights to patrol coastal areas—unarmed because most of the aircraft used were incapable of carrying the weight that ordinance entailed, in addition to

⁴⁶ Christopher M. Bell, *Churchill and Sea Power* (Oxford: Oxford University Press, 2013), 76–77.

⁴⁷ Alfred Price, *Aircraft Versus Submarine In Two World Wars* (Barnsley, South Yorkshire, England: Pen & Sword Aviation, 2004), 2.

⁴⁸ Price, *Aircraft Versus Submarine*, xiv.

an observer as crew.⁴⁹ From May 1918 until the armistice, the scarecrow flights sighted sixteen U-boats and conducted eleven attacks. Although no U-boats were damaged, they were forced to submerge and prevented from attacking shipping.⁵⁰ Despite early limitations, aircraft proved themselves an invaluable asset, and as advances in technology led to greater speed and range, they become crucial in antisubmarine warfare.

⁴⁹ Price, *Aircraft Versus Submarine*, 20.

⁵⁰ *Ibid.*, 21.

II. THE RISE OF A RIVAL STRATEGY

After World War I, the British government struggled to achieve a collegiality and cooperation among its protective services that would allow for the development of a comprehensive strategy employing every branch (army, navy, and air force) to best advantage. But the independent services fought one another for funding and prestige. The Royal Navy's blockade had helped end the war, and yet the cost of building and maintaining a fleet of modern warships had drained the British economy, while its contribution was perceived as negligible. Military aircraft had proved that Britain was not as safe from its enemies as it once was, and Great Britain's dependency on its once supreme navy was in doubt.

This chapter explains how the Royal Air Force (RAF) developed and gained political and financial support for an offensive air strategy that was based on untested assumptions and that proved inadequate during World War II.

A. THE CREATION OF THE ROYAL AIR FORCE

From the 18th to early 20th centuries, Great Britain was the world's premier naval power. This small kingdom governed colonies across the globe by dominating the ocean sea. During World War I, the role of naval power began to change. Britain's navy contributed significantly to the defeat of Germany by enforcing a blockade; but World War I was predominantly a land war—it took armies to control territory and prevail. Added to this reality was a new threat that deeply alarmed the British people, namely, aerial attack. Aircraft in World War I were used for reconnaissance and, eventually, artillery spotting. Fighter aircraft were developed to counter these advantages by establishing small zones of air superiority. Near the end of World War I, a third role for aircraft was developed: strategic bombing. Britain's first experience with this deadly innovation was the Zeppelin bombing raids over London in 1915. Britain established a civilian air-defense system, but this proved inadequate under Gotha bomber attacks on

London and southern England in July–July 1917.⁵¹ The Gotha raids were profoundly shocking to the people. The war had been distant, fought offshore and overseas. Technological advancements now demonstrated that it was possible for England's population to be attacked at home.

The Gotha raids caused the British to realize that their ancient defense of physical isolation had crumbled; they could no longer depend solely on a strong navy for protection.⁵² The bombing and its demoralizing effect on British subjects spurred the government to create a separate branch of the armed forces whose immediate purpose was to prevent attack by air.

Brass within the navy and army argued against an independent air force, fearing it would not meet their needs.⁵³ Competition for the control of air assets had begun well before, with the navy training pilots and acquiring aircraft independently of the army's Royal Flying Corps. The creation of the RAF on April 1, 1918 changed how pilots and aircraft were allocated. The RAF took control of pilot training and aircraft procurement, which sparked intense arguments from the navy and army. This point of contention would resurface repeatedly in the interwar period, ultimately requiring the prime minister to pronounce a compromise.⁵⁴

World War I ended before the RAF could test any large-scale offensive operations. Part of the rationale for an independent air force was to avoid army–navy competition for control of aviation resources. If the RAF had been re-absorbed by the army and navy after the war, it is likely that further development of air power would have been sidelined by both services in favor of more familiar concerns and requirements.

Faced with a growing deficit after World War I, Parliament cut the military budget radically. Further, the committee of imperial defense (CID) requested memos from all service branches outlining their roles, responsibilities, and expense justifications.

⁵¹ Scot Robinson, *The Development of RAF Strategic Bombing Doctrine, 1919–1939* (London: Praeger, 1995), 17.

⁵² Robinson, *The Development of RAF Strategic Bombing*, 42.

⁵³ Barnett, *Engage the Enemy More Closely*, 12.

⁵⁴ *Ibid.*, 26.

Complicating matters, in August 1919 the government enacted the ten-year rule, which stated that the empire would refrain from any large-scale conflict for ten years. This law devastated funding for the military and greatly influenced how the RAF developed. The untried, upstart service had to find roles to fill to justify its existence, under pressure by both peacetime budgets and its rival services, which argued that a separate air force was wasteful.⁵⁵ Because of this, air staff spent much of their first decade arguing for the RAF's right to exist, rather than developing doctrine.

Sir Hugh Trenchard, chief of the air staff (CAS), employed the RAF in policing crown colonies, arguing that airpower could control territories cheaply under the assumption that regions of low development had neither the planes nor means to oppose the RAF. Trenchard published a memorandum in August 1919 spelling out his concepts, and shortly thereafter, the RAF flew air-control missions in Mesopotamia. In 1921, Winston Churchill, as colonial secretary, endorsed further air-control missions, which had proved more successful and thrifty than deploying the army.⁵⁶ These policing and air-control operations gained further support for the RAF as an independent service, and were expanded. These missions also gave the RAF an opportunity to conduct operational research and develop better techniques and equipment for delivering bombs.⁵⁷

The rivalry between the RAF and Royal Navy was exacerbated by conflicts over aircraft procurement, which had been delegated to the air ministry in 1918 upon the creation of the RAF. The air ministry and air staff placed a priority on strategic-bomber needs and treated the development and procurement of fighter aircraft as secondary. Carrier and shore-based maritime-patrol aircraft were relegated to third place.⁵⁸ The navy's persistent argument for fielding its own aircraft resurfaced in 1936, and at the end of July 1937, it was allowed to develop and acquire a carrier aircraft. However, the minister of coordination of defense, Sir Thomas Inskip, kept all shore-based maritime-patrol aircraft under the control of the RAF, which continued to neglect their

⁵⁵ Barnett, *Engage the Enemy More Closely*, 26.

⁵⁶ *Ibid.*, 31.

⁵⁷ *Ibid.*, 33.

⁵⁸ *Ibid.*, 39.

development.⁵⁹ The failure to develop purpose-built carrier-based aircraft contributed to the poor performance of carrier aviation in the early stages of World War II.

Trenchard presented several documents to the CID outlining a proposal for the role of air power. Arguing that air power should be the primary means by which to pressure an enemy to negotiate peace, he maintained that it could more efficiently wreak devastation than could the navy or army. He reminded the CID that Britain was vulnerable to air threats and must be prepared to counter such threats by the best means possible: an independent RAF. Trenchard observed that the air service could turn back an invasion by sea, citing the U.S. Army Air Corps' sinking of the former German battleship *Ostfriesland* as an example.⁶⁰ Trenchard envisioned an RAF responsible for both air and coastal defense.⁶¹

Winston Churchill, as first lord of the admiralty during World War I, had been frustrated by the defensive posture of the Royal Navy. He noted that the navy had drawn tremendous resources during the war, but had not contributed decisively, as the war was fought predominantly on land. After the failure of the Dardanelles campaign in 1915, Churchill was replaced as first lord and retreated somewhat as a public figure. In 1924, however, when the government majority shifted from Labor to the Conservative party, he was made chancellor of the exchequer, serving until 1929. As chancellor, Churchill was in a position to challenge the navy's budget figures. The admiralty viewed Japan as a growing naval threat and used the situation to justify major new naval construction.⁶² Churchill argued that Japan was unlikely to attack British interests in the Far East and called for more modest proposals. His efforts to reduce ship construction contributed to the deterioration of the naval shipbuilding industry in the 1920s and 1930s.⁶³ The Labor Party, which came to power after he left the exchequer, cut naval expenditures further, compounding the problem.

⁵⁹ Barnett, *Engage the Enemy More Closely*, 39.

⁶⁰ Robinson, *The Development of RAF Strategic Bombing*, 36.

⁶¹ Ibid., 37–8.

⁶² Bell, *Churchill and Sea Power*, 103.

⁶³ Bell, *Churchill and Sea Power*, 132.

Disputes about the hierarchy of defense plans and competition for support contributed to a fragmented defense policy overall. Disagreements among the services became a problem when politicians who lacked military expertise were called upon to evaluate competing proposals and use them to change defense strategies. RAF proposals were popular because they offered an offensive strategy that purported to win wars faster than the navy's defensive approaches, at lower costs than anything the army or navy could quote. Many politicians, including Winston Churchill, favored offensive actions. World War I had demonstrated that the Royal Navy, used defensively, was only marginally effective in a terrestrial conflict. In general, any proposal that offered an offensive over a defensive plan was more likely to be well received.

The economic and political rivalry among the services was a factor in the justification of funding in the interwar period. The RAF in particular exploited the deflation of the Royal Navy's reputation, arguing that the air force could wage large-scale offensives against a continental adversary with far fewer casualties than the army could achieve. Though these scenarios appealed to Parliament, most of these claims were speculative. Air power in World War I was, at best, a supportive effort and no more assured the outcome of the Great War than did the naval blockade.⁶⁴

One of the first documents drawn up for the CID to argue for strategic bombing was presented by the air staff in December 1921.⁶⁵ This document asserted that France was the only continental nation capable of threatening England by air. It estimated how much ordnance might be dropped, assuming London as the primary target, rather than industrial centers or military bases,⁶⁶ and argued that such attacks would necessarily continue many days, making repairs problematical and precipitating widespread disruption of government functions and internal communications. Staff emphasized the impact of bombing on civilian morale, believing that the psychological fallout would be disproportionate to the material damages incurred. It also predicted that biological or

⁶⁴ Robinson, *The Development of RAF Strategic Bombing*, 19.

⁶⁵ *Ibid.*, 44.

⁶⁶ *Ibid.*, 45.

chemical weapons would be dropped on civilian targets and concluded that a bombing campaign could break the will of a target nation.⁶⁷

The air staff did not believe it possible to defend against an air attack, other than to launch a counterattack, and argued that the side that delivered the first blow had the advantage.⁶⁸ The strategy proposed by the air staff is summarized in the following excerpt:

It is accepted that a vigorous offensive against the enemy is the surest form of defense ... passive defense is more than ordinarily inefficient and only by means of an offense can the air forces of the enemy be satisfactorily contained; in addition, such offensive is a powerful means of influencing the morale of the enemy population, who may compel their Government, as a result, to sue for peace in order to secure relief from the constant presence of hostile aircraft.⁶⁹

In contrast to the RAF's propensity for seizing the offensive, the navy preferred battles that involved decisive exchanges between warships and resulted in control of the sea. Such control, however, was no longer a guarantee of protection for the British civilians. In its counterarguments, the Navy disputed RAF assumptions about the destruction of warships by air and argued that the conclusions drawn from the American experiment were unrealistic: the ship that was sunk was at anchor and no attempts were made to return fire at the attacking aircraft, which was able to release its bombs at low altitude. The navy stated that under realistic operational conditions, it would be much more difficult, if not impossible, to sink a warship.⁷⁰ For its part, the army contradicted the RAF's assumption that a strategic-bombing campaign would encourage the enemy to sue for an earlier peace, arguing that air power alone was insufficient and that, moreover, the air force's claims were completely unproven.⁷¹ Despite these valid observations, RAF proposals won the support of government.

⁶⁷ Robinson, *The Development of RAF Strategic Bombing*, 46.

⁶⁸ Ibid.

⁶⁹ Memorandum by the Air Ministry, AIR 8/39, *The Additional Measures, If Any, Required to Meet the Existing Situation*, March 1922 (London, 1922)

⁷⁰ Robinson, *The Development of RAF Strategic Bombing*, 51.

⁷¹ Ibid.

The RAF's proposed strategy for continental warfare had signal advantages. It cost less than that proposed by the navy or army; it spared more British servicemen and promised a quicker peace than conventional methods. Furthermore, air power would reduce the need for the army's expeditionary force, offer a strong defense through a strong offensive potential that the navy could not ensure, and most importantly, it would save the government considerable funds.⁷² Thus the RAF's strategic bombing doctrine gained support with politicians.

Nevertheless, the RAF proposal was flawed. The theory that aggressive bombing would reduce the morale of the enemy to the point of negotiation was not based on measurable figures or genuinely relevant historical experience. The RAF also failed to consider that the advances in technology needed to enable the accurate delivery of bombs, or to afford aircraft the payload and range capabilities necessary to attack the continent, had not yet been developed.⁷³

The Royal Navy and the army, headed by the first lord of the admiralty and the imperial general staff, were unable to counter the arguments posed by the air staff to the CID. Government and public opinion had shifted in the 1920s to fear an enemy bombing threat above all and to believe that the only reasonable defense was by an air force capable of conducting an independent, long-range, offensive bombing campaign.⁷⁴ What is ironic is that the air staff, which having struggled to justify the RAF's existence had then set about challenging the long-held strategies of the army and navy, failed to develop a long-range offensive-bombing capacity.

This inter-service rivalry led to the erroneous idea that the RAF alone could force an enemy nation to negotiate for peace quicker and at less cost to the British government than other forms of fighting. The RAF created a strategy that proposed a strong offense to quickly end a conflict rather than depend upon a defense, based on command of the sea, that was beginning to be less effective. This idea eventually gained political support

⁷² Robinson, *The Development of RAF Strategic Bombing*, 53.

⁷³ Ibid., 59.

⁷⁴ Ibid., 53.

and became the dominant strategy when Britain declared war against Germany in 1939. Subsequently, the RAF doggedly funneled most of its resources into the Bomber Command, neglecting Coastal Command's needs.

There are two reasons for this crucial decision. The most important was budget constraints—as noted, the decade after World War I was a period of severe military cuts. Second, the air staff was focused on justifying its existence and arguing major shifts in strategy. It neglected to devote energy to operational testing and technological development. As proof of this failure, when Britain began rearmament in 1936, a review of the operational capacity of the bomber command revealed that its aircraft could barely reach Berlin with a limited payload capacity. Moreover, bomber design failed to provide for critical subsystems such as defense, navigation, and accurate bomb-delivery technology.⁷⁵

Both the RAF and navy failed to conduct operational research and design during the interwar period. After World War I, the government closed its aircraft factories and subsequent aircraft production was completely private. The constraints of the 1920s limited the RAF's ability to contract for new aircraft. However, the 1920s and 1930s also marked a period of rapid design innovation, with major improvements achieved in speed, range, and endurance. Despite these rapid advances, the RAF did not create a department for research and design until 1936, and it was not elevated to a full directorate until 1939. This lack of forethought is seen in the aircraft available to RAF squadrons in the late 1930s. Because design specifications were compartmentalized, many innovations that occurred in one type of aircraft were unknown in others. This was most apparent between single-seat fighters and bomber planes. The prevailing understanding, based on studies of World War I aircraft, was that fighter aircraft were only marginally useful, as a defense against bombers, so fighter innovation was largely ignored.

B. BRITAIN'S STRUGGLE TO REARM

The RAF was not the only entity that faced lean years. The British national debt by 1919 was £7,435 million. Britain owed the United States alone £1,365 million, which

⁷⁵ Robinson, *The Development of RAF Strategic Bombing*, 59–61.

forced the government to make deep budget cuts.⁷⁶ The navy's budget fell from £344 million in 1919–1920 to £76 million two years later. Britain's economy experienced a downturn after World War I, unlike America's. The Royal Navy was dethroned as the largest in the world—the U.S. Navy's shipbuilding program, if maintained, would surpass Britain's by 1923. Nevertheless, in 1922 the United States invited Britain and Japan to a conference in Washington to negotiate a treaty that would limit the size of navies. The agreed-upon ratio in the Washington Naval Treaty was 5:5:3 in capital ships, with Britain and the United States limited to no more than five each and Japan limited to three.

The treaty also limited total tonnage to 500,000 for the United States and Britain and 300,000 for Japan. This meant that the U.S. Navy would remain equal with the British; but the treaty also imposed a ten-year moratorium on new ship construction, which led to a much weaker Royal Navy in the years to come, because its fleet was older than the American or Japanese. Nor did the agreement consider that Britain possessed many colonies around the globe, which required a robust fleet to maintain.⁷⁷

The London Naval Treaty of 1930 further vitiated the Royal Navy, cutting the number of cruisers from seventy to fifty—less than half the navy's inventory at the beginning of World War I. Cruisers were essential for imperial policing, as well as for escorting convoys, and the 114 available at the beginning of the World War I had not been enough to meet demand during the war. British naval aviation also fell behind because of the lack of development in the interwar years, leaving its fleet equipped with obsolete aircraft. The air staff had neglected naval aviation, adding only 150 aircraft in this period, as compared to the U.S. Navy's 400 modern carrier aircraft.⁷⁸

Britain began to rebuild its military in July 1935, after the British cabinet authorized a program to strengthen the armed forces. Adolf Hitler had acknowledged that the *Luftwaffe* (air force) had been rebuilt, which spurred Britain to enlarge the RAF. The

⁷⁶ Barnett, *Engage the Enemy More Closely*, 19.

⁷⁷ *Ibid.*, 20–2.

⁷⁸ *Ibid.*, 24–25.

British government did not endorse large-scale rearmament until February 1936, well after Germany had begun rebuilding its power.⁷⁹

British rearmament was delayed for several reasons. The first was economic: the large debt incurred during World War I and the global depression that began in 1929 had worn down political support for military spending. Second, the British public invested their faith in disarmament treaties and the League of Nations to resolve peacefully any disagreements among nations. The government had developed a fear of enemy bombers by this point, so the RAF received priority funding.⁸⁰ The Washington Naval Treaty, with its ten-year break from shipbuilding, caused manufacturing problems in the industrial sector. Given lack of demand, the steelyards cut production. In 1937, when the navy needed new ships, the steel industry could not meet demand and the specialty machining required to produce large, modern ship's guns was not available, which forced the Royal Navy to purchase overseas.

Military budget cuts affected all three services. The navy received a larger sum than the army or RAF; however, its projects (mainly shipbuilding) were orders of magnitude more costly than any proposed by the other services. From 1920–1938, the average annual expenditure for the navy was £64.3 million; for the army, £54.4 million; and for the RAF, £24 million.⁸¹

C. IDENTIFYING THREATS AND THE ENEMY

During the interwar period, the Royal Navy viewed the Japanese navy as its future primary adversary. In 1902, the two navies had established a pact of alliance, which was subject to renewal every five years. Britain failed to renew this agreement in 1922, which distanced Japan diplomatically. Japan, meanwhile, had begun a period of expansion that led to the invasion of Manchuria.⁸² British budget cuts curtailed the development of a naval base in Singapore, which weakened imperial support for Far East colonies.

⁷⁹ Barnett, *Engage the Enemy More Closely*, 36.

⁸⁰ Ibid., 37–36.

⁸¹ Terraine, *The U-Boat Wars*, 156.

⁸² Ibid., 157.

Meanwhile, Japan began building larger capital ships that rivaled those of the Royal Navy.⁸³ The growth of the Japanese navy, contrary to the provisions of the Washington Naval Treaty, gave the admiralty and naval staff cause for alarm, and the resulting focus on large surface combatants contributed to an atrophy in antisubmarine readiness.⁸⁴ The admiralty assumed that the submarine menace had been solved by convoys and minefields in World War I, and because U-boats were forbidden in the Treaty of Versailles, naval brass did not consider the evolution of antisubmarine warfare an important issue in the interwar period.⁸⁵

When Britain declared war on Germany in September 1939—just twenty years after the armistice—Britain immediately resumed merchant convoys. The admiralty believed that the new ASDIC (SONAR) technology, in conjunction with protective escorts, would prevent the shipping toll of World War I. Whereas in 1918, 300 escorts were employed for convoy protection,⁸⁶ the admiralty predicted in 1934 that a hundred ships for convoy escorts would satisfy naval requirements—never realizing how quickly Germany would build a larger, more capable U-boat fleet.

Given the formidable history of German pressure on the British merchant marine, the decision to allocate so few aircraft to coastal command to assist the navy against U-boat attacks in World War II was shortsighted. As Germany's new fleet of U-boats began slipping past escorts and picking off shipping, the Royal Navy realized it was not prepared.

Coastal-command aircraft used in antisubmarine missions required long range and endurance. These antisubmarine patrol aircraft were primarily used as deterrents. Particularly at the beginning of the war, British aircraft lacked the weapons and delivery systems necessary to strike submarines. Rather, their value was in locating submarines and reporting position, course, and speed so that convoys could be evasively rerouted and friendly surface combatants directed to attack. A submarine at risk of detection by aircraft

⁸³ Terraine, *The U-Boat Wars*, 158.

⁸⁴ *Ibid.*, 160.

⁸⁵ Barnett, *Engage the Enemy More Closely*, 45.

⁸⁶ *Ibid.*, 45.

was forced to conceal itself by submerging, which slowed its transit and drained batteries. The relatively few aircraft available with long range and endurance were almost exclusively allocated to the RAF bomber command—a decision that suggests where Great Britain's best hope of winning World War II was placed.

III. THE BEGINNINGS OF THE BATTLE OF THE ATLANTIC

Great Britain was slow to react to German expansionism, which began shortly after the Nazis eliminated political opposition in 1933. Britain gradually began to restructure and rearm in 1936, but only in response to Germany's growing hostility.

As noted, British shipyards had lost the technical expertise needed for modern warships. The RAF had also failed to keep up with technological advances in aviation, which hampered the production of aircraft capable of meeting strategic goals. The restructuring of 1936 included dividing the RAF into three distinct commands with different priorities. The bomber command focused on delivering ordnance to enemy targets. The fighter command attacked aircraft. The coastal command was the RAF's maritime component after the navy resumed control of the fleet air arm in 1937. This component was neglected, however; when war broke out in 1939, the coastal command had few aircraft, and many of these were obsolete.⁸⁷

By the fall of 1939, Adolf Hitler was determined to occupy Poland. Considering the international implications of German expansion, before committing troops to the invasion he sought to secure the agreement of the Soviet Union, which resulted in the German-Soviet Non-Aggression Pact. Given the certainty that the Soviets would not intervene, Hitler was convinced that the British would not react to the invasion with a declaration of war.

Hitler had no ambition to fight Britain, nor did he have a formal plan for European conquest in 1939. The German military was unsure of the next move after seizing Poland.⁸⁸ France and Britain declared war, but neither undertook an immediate offensive action. The day Britain declared war—September 3, 1939—a U-boat torpedoed the British commercial liner SS *Athenia*, in direct violation of Hitler's orders to naval

⁸⁷ Barnett, *Engage the Enemy More Closely*, 49.

⁸⁸ Earl F. Ziemke, *The German Northern Theater of Operations 1940–1945* Department of the Army Pamphlet, No. 20–271 (Washington, DC: GPO, 1959), 3.

leaders to adhere to the Hague Convention. This order reflected the Führer's hope of a peace agreement with Britain once Poland was conquered.⁸⁹

A. BRITAIN'S GRAND STRATEGY

Britain's initial war strategy against Germany was based on a number of assumptions: Britain and France combined had greater resources than Germany; because Germany had begun rearmament more aggressively, it had a much larger and more capable army and air force than Britain or France (though not larger than the two combined); and Britain still had the largest navy, but its fleet was elderly compared to those of Germany, Japan, or Italy.

Under these propositions, Britain and France chose a defensive posture at the beginning of the war, including a British naval blockade to restrict the Germany economy. The Allies planned to hold off German territorial expansion while waiting for their combined resources to provide materiel sufficient to allow land and air forces to take the offensive.⁹⁰ They calculated that economic warfare would weaken Germany, but did not consider Germany's ability to draw on resources from the Soviet Union, Italy, and much of Eastern Europe.⁹¹ Allied political and military leaders would have preferred a more offensive posture, but their military forces were not a match for Germany's.

B. ALLOCATING RESOURCES FOR BRITAIN'S WAR EFFORT

London's politicians wanted victory as quickly as possible. Many felt that staying on the defensive would prolong the war. With Britain's army and the RAF too weak to confront German land forces directly, many looked to the Royal Navy for aggressive action. World War I had demonstrated that naval power was limited in confronting continental land forces. In 1939, Churchill, as first lord of the admiralty and civilian head of the Royal Navy, believed the navy had used more resources than it need have in World

⁸⁹ Barnett, *Engage the Enemy More Closely*, 66.

⁹⁰ Bell, *Churchill and Sea Power*, 160.

⁹¹ *Ibid.*, 162.

War I, and now believed the navy could use even less, because its superior size vis-a-vis the German navy made it capable of greater offensive action.

Part of this idea came from the belief, shared by most of the admiralty, that mercantile attacks were not likely to occur again—that convoys and ASDIC had solved the problem of safe passage. The war cabinet was more concerned with the problem of the army's consumption of resources; predicting that aerial warfare would be the most important factor in the conflict, they preferred to funnel resources to the RAF.⁹²

The admiralty disagreed with Churchill about the importance of the navy. Admiral Sir Dudley Pound, commander of the Royal Navy, was concerned about the growing threat of the Japanese and Italian navies and argued that the Britain should continue to produce large warships. Churchill was focused on Germany and considered the existing combined British and French fleets sufficient to defeat the Germany navy. Rather than supporting greater capital ship production, Churchill called for offensive naval actions.⁹³ His memoirs reveal a concern that Germany would at some point rapidly build more U-boats, and thus he favored increased production of escort ships. However, he took little action to acquire such escorts until the shipping situation worsened in the years to come.

C. BRITAIN'S NAVAL LINES OF COMMUNICATION

The immediate threat to Britain's commerce in 1939 was Germany's pocket battleships. Built to conform to restrictions imposed by the Treaty of Versailles, these small vessels were faster than British cruisers and carried larger guns, which made them ideal as commercial raiders. At the onset of the war, the U-boat fleet was small: fifty-seven craft, only half of which could be used for open-ocean operations. Hitler had ordered commanders to comply with prize regulations and avoid attacking without warning. When Britain declared war, he relaxed restrictions, and by mid-November 1939, U-boats were free to attack any ship identified as hostile.⁹⁴ Although Hitler was slow to

⁹² Bell, *Churchill and Sea Power*, 161.

⁹³ *Ibid.*, 171.

⁹⁴ V. E. Tarrant, *The U-Boat Offensive 1914–1945* (Annapolis: Naval Institute Press, 1989), 84.

approve more U-boat construction,⁹⁵ he authorized unrestricted attacks much more quickly than had the German command in World War I.

In October 1939, a significant counter to British convoy escorts was tested by Karl Dönitz, commander of the U-boat fleet and a U-boat veteran of World War I. Dönitz tried deploying groups of U-boats working together to attack convoys and evade escorts. This tactic was initially ineffective, because there were only three craft available for the first attempt.⁹⁶ Dönitz waited for greater numbers before trying again, as Germany had too few U-boats at the time to seriously threaten British shipping, and construction from September to May was just slightly higher than the rate of loss.⁹⁷

Britain began protecting its maritime commerce by initiating convoys and laying minefields in the English Channel in October 1939, and the North Sea soon thereafter. Germany's low inventory of U-boats and Britain's prompt convoying meant light shipping losses for the first four months of the war.⁹⁸ Another factor was torpedo failure. The magnetic detonating-pistol mechanism often failed, which occasionally damaged the U-boat that fired it and revealed its position, besides botching the intended attack. Dönitz reported that at least twenty-five percent of German torpedoes were duds, which damaged crew morale and U-boat effectiveness.⁹⁹

Churchill wanted a more offensive navy and initiated plans to send part of the British fleet to harass the German navy in the Baltic Sea; but the admiralty, anticipating that Italy and Japan would soon join the war, opposed dividing the fleet, and the plan for Baltic operations never came to fruition. In another effort to encourage offensive naval action, Churchill supported a plan for naval search groups to hunt for German ships.

Britain's home fleet had two aircraft carriers: the HSM *Courageous* and the new HMS *Ark Royal*. These were paired with destroyer escorts and deployed to hunt for U-

⁹⁵ Bell, *Churchill and Sea Power*, 166.

⁹⁶ Price, *Aircraft Versus Submarine*, 41

⁹⁷ Tarrant, *The U-Boat Offensive*, 84.

⁹⁸ Bell, *Churchill and Sea Power*, 166–67.

⁹⁹ Tarrant, *The U-Boat Offensive*, 83.

boats, but carrier search groups proved vulnerable—on September 14, 1939, *Ark Royal* was attacked by U-boat, narrowly escaping severe damage when the torpedoes detonated early, and three days later, *Courageous* was sunk in the Bristol Channel.¹⁰⁰ It was concluded that search groups were unproductive against U-boats, as compared to convoy-escort attacks.¹⁰¹

D. THE GERMAN CAMPAIGN IN SCANDINAVIA

Weeks later, as the German–Soviet campaign in Poland was mopping up, Grossadmiral Erich Raeder, commander of the Germany navy, met with Hitler to propose unrestricted submarine attacks against England to counter the blockade and reduce Britain’s potential against Germany.¹⁰² Hitler was ambivalent and made no commitment. In a follow-up on October 3, Raeder presented naval staff with three possible campaigns that the German high command had proposed: a land campaign in the west, which would focus Germany’s resources on the army and air force; a naval siege of Britain, calling for a large submarine and air campaign to wear down its warfighting ability; and a defend-and-delay strategy using naval and land forces to hold newly occupied territory.

The German high command thought the first option unlikely and a siege of Britain most promising. Raeder recognized that the submarine command was not ready for a campaign of such magnitude—the fleet had only twenty-nine fully operational U-boats (*Frontboote*). Raeder also expected the Royal Navy to close the English Channel and the northern route between Norway and the Shetland Islands,¹⁰³ and he coveted naval bases in Norway for open access to the Atlantic.

The naval staff acknowledged that bases in Norway would be useful to submarines, but argued it would not have a surface fleet to exploit them until after new construction in 1945. Until then, the distance of these bases from Germany would diminish their value. Hitler, meanwhile, was more interested in a land war in the west; on

¹⁰⁰ Barnett, *Engage the Enemy More Closely*, 69–70.

¹⁰¹ Tarrant, *The U-Boat Offensive*, 86.

¹⁰² Ziemke, *The German Northern Theater*, 3.

¹⁰³ *Ibid.*, 4.

October 9, he issued Führer Directive No. 6, which called for a main effort by land. Raeder continued his U-boat campaign against merchant shipping, but was constrained by the dearth of operational ships and adherence to prize rules, which required that merchant crews be removed to safety before their ship was sunk and that only warships or other direct threats could be attacked without warning.

Hitler changed his priorities with Führer Directive No. 9, published November 29, 1939, in which he declared that the way to defeat Britain was by strangling its economy. He would defeat the French and British armies on the continent, then shift to a naval and air war against Britain.¹⁰⁴ Raeder again attempted to sway Hitler to a campaign in the north, arguing that Norwegian ports were critical to Hitler's new directive. Raeder emphasized that if Britain were allowed to occupy these naval bases first, Germany would be cut off from the North Atlantic. Ultimately, Hitler figured Britain would ignore Norway's neutrality and, as a preventive measure, ordered a pre-emptive invasion of Norway to guarantee supplies of Swedish iron ore and forestall British intervention in Scandinavia.

Germany's operation *Weserübung* into Norway and Denmark surprised Britain. Churchill had been pushing the war cabinet to interdict Swedish shipments of iron ore to Germany and sponsored a plan to mine Norwegian waters around Narvik to break the supply chain.¹⁰⁵ Churchill's efforts, however, were frustrated by disagreements among the war cabinet, the chief-of-staff committee, and heads of government. There was concern that infringing on the sovereign rights of a neutral country would create a divide between Britain and Scandinavia, which Germany might exploit. Britain's hesitation gave the German military time to plan an invasion of Norway and Denmark, assuring its supply of iron ore and providing the navy with advantageous ports opposite England.

Allied leaders were shocked, because they had assumed that British naval superiority would deter any German plan that depended on the transport of men and materiel by sea. In preparation for *Weserübung*, the German navy withdrew its U-boats

¹⁰⁴ Ziemke, *The German Northern Theater*, 7.

¹⁰⁵ Bell, *Churchill and Sea Power*, 175.

from shipping patrol and posted them in the North Sea to protect the invasion fleet. Britain attempted to liberate the seized territories, but despite successful landings at Narvik on April 13, 1940, the military-coordination committee decided to send reinforcements to Trondheim instead. This split in priorities and division of resources to liberate both Narvik and Trondheim led to stalls and delays that allowed Germany to reinforce its positions.

Eventually, on May 28, 1940, Allied forces pushed the Germans out of Narvik. But attempts to liberate Trondheim failed, and after Germany captured France in late June, the war council withdrew all remaining forces from Norway.¹⁰⁶ One result of the German occupation of Norway and Denmark was that the British public lost confidence in Prime Minister Neville Chamberlain, which triggered a change in leadership. Winston Churchill was appointed prime minister on May 10, 1940, putting him in a strong position to urge an offensive stance.

E. SHIFTS IN BRITAIN’S GRAND STRATEGY

After the takeover of Norway and Denmark, Hitler concentrated his forces on the conquest of France and the Low Countries. When France fell in late June 1940, the strategic situation before Britain was very different from what it had been at the start of the war. Options were limited; unable to confront the Germany army in Europe directly, Churchill and the military looked to the African and Mediterranean theaters for a more equal footing. Churchill recognized that the navy needed to take the offensive if it were going to contribute to the war, because the maritime blockade was losing effectiveness as German resources increased. Above all, Churchill and policymakers felt that their best hope for victory lay with the RAF, the only branch capable of attacking targets in Germany.¹⁰⁷

While Germany could draw on resources from most of the continent, Britain could no longer depend on material support from France. Germany could base U-boats along the French coast for access to the Atlantic and use French air bases to strike a

¹⁰⁶ Bell, *Churchill and Sea Power*, 192.

¹⁰⁷ *Ibid.*, 196.

greater portion of Britain. Amplifying the threat to Britain, Italy joined the war in early June 1940, as the French were retreating from the German advance. A well-supplied Germany could not be pressured economically as easily as before the fall of France, and though the French fleet was controlled by the Vichy government, it would need to be neutralized if German forces seized control.

After Norway, the German fleet needed rebuilding and repair. By June 1940, it had regrouped, with sixteen U-boats hunting the western approaches. French naval bases on the north coast allowed U-boats to patrol further west, outside the range of the coastal command's aircraft.¹⁰⁸ From June to December 1940, U-boats sank an average of 240,000 tons per month, and by August, *Frontboote* strength had increased from sixteen to twenty-seven U-boats. Attrition had depleted the operational U-boats since the start of the war, and new construction had fallen behind the rate of loss.

Shifting U-boat patrols beyond the range of the coastal command led to higher rates of merchant loss and fewer U-boat casualties. With Germany occupying ports in Brest, Lorient, Saint Nazaire, La Rochelle, and Bordeaux, Britain abandoned shipping routes in the southwestern approaches and directed all convoys through the North Channel.¹⁰⁹ U-boats prowled the Atlantic as far as 25 degrees west, beyond the point where convoy escorts detached and returned to England, and the convoys proceeded alone.¹¹⁰ In response, the admiralty expanded escort coverage by 19 degrees west, but not beyond, because of insufficient escort ships.

By the fall of 1940, enough U-boats were operational that wolf-pack tactics were again attempted. The preferred technique was to stage a group of U-boats on the surface, at night, in a position to intercept a convoy. Once the convoy was sighted, the wolves would attack multiple targets simultaneously. British escort ships soon learned that ASDIC equipment could not detect surfaced U-boats, and darkness made locating U-boats substantially more difficult. By coordinating their attacks, the U-boats brought

¹⁰⁸ Price, *Aircraft Versus Submarine*, 45.

¹⁰⁹ Tarrant, *The U-Boat Offensive*, 90.

¹¹⁰ *Ibid.*, 90.

greater force to bear against the escorts, negating the superiority in numbers that escorts had earlier enjoyed. Wolf-pack tactics were efficient, but dependent on radio transmissions. Remaining surfaced also meant that U-boats could outrun those escort ships that were able to spot them at night.¹¹¹

F. THE BATTLE OF BRITAIN

After the fall of France, Britain had to focus on survival. The threat of imminent German invasion led the navy to withdraw some convoy escorts to strengthen coastal defenses. In July 1940, the Luftwaffe launched a campaign for the control of British skies. The *Kriegsmarine* (German navy) had been severely damaged during the invasion of Norway and Denmark and was not able to withstand the British Navy.¹¹² Admiral Raeder, as commander of the *Kriegsmarine*, explained to Hitler that an invasion of Britain could only be considered after the Luftwaffe had cleared the skies, destroyed the British home fleet, and controlled the English Channel. On July 16, Führer Directive No. 16 called for preparations for the German invasion of Britain to begin.¹¹³

The Luftwaffe targeted formations in flight, airports, supply centers, infrastructure, and aircraft factories. The RAF suffered a shortage of pilots, and as they drew personnel from the fleet's air arm and the coastal command to meet demand, the air cover available for escorting convoys grew thin.

In late August, German pilots accidentally bombed civilians in London, which led Churchill to order a bombing raid on Berlin. Enraged, Hitler changed the Luftwaffe mission to terror-bombing London, which actually detracted from the strategic goal of weakening the RAF and gave it a chance to recover from recent losses. By September, the Luftwaffe had failed to gain control, and the last window of favorable weather for a massive crossing of the Channel closed. Under these circumstances, Hitler postponed invasion until the following year.¹¹⁴ He had since late July contemplated a campaign

¹¹¹ Tarrant, *The U-Boat Offensive*, 93.

¹¹² Eddy Bauer, *The History of World War II* (New York City: Galahad Books, 1979), 107.

¹¹³ *Ibid.*, 109.

¹¹⁴ *Ibid.*, 112.

against the Soviet Union, and as this would preoccupy many of the resources he had planned to use for the invasion of Britain, his scheme was advantageous to the British. An additional benefit was that Germany could no longer count on resources from the Soviets, as they had during the invasion of Poland, and Britain gained a powerful ally against a common enemy.

G. BRITISH NAVAL COUNTERMEASURES

British countermeasures to wolf-pack tactics took time to evolve. Escort ships started coordinating their counterattacks to maximize their few resources efficiently. Dividing the convoyed ships into groups, they assigned an escort vessel to each unit. Communication between merchantmen, escorts, and patrol aircraft was improved by the introduction of high-frequency radio telephone (TBS).

But though improved organization made counterattacks more effective, the convoys continued to suffer a shortage of escort vessels and inadequate air cover, which the admiralty addressed by requesting that warships reserved for home defense be released for escort duty. When British intelligence reports began indicating that the invasion planned for the fall in 1940 had been postponed, the chiefs of staff (COS) committee was able to respond to this request.¹¹⁵ As shipping losses mounted, Ronald Cross, the minister of shipping, began warning about the price of the cumulative damages. In November 1940, the first lord of the admiralty requested that the aircraft for coastal command be tripled.¹¹⁶ Churchill, advocating offensive action as usual, opposed the request to reassign aircraft from the bomber to coastal command, because it would draw resources away from the bombardment of Germany.

Much like the U-boats, Germany's surface fleet was used to raid merchant shipping, with its pocket battleships and battle cruisers highly effective during the first few years of the war. After the battleship *Bismarck* was sunk in May 1941, Germany stopped using its surface fleet against merchant ships.¹¹⁷

¹¹⁵ Bell, *Churchill and Sea Power*, 216.

¹¹⁶ *Ibid.*, 217.

¹¹⁷ *Ibid.*, 215.

H. BRITAIN'S CONCERN WITH THE FAR EAST

Churchill pushed for more offensive naval actions in the Mediterranean while also continuing to support the RAF's offensive bombing campaign against targets in Germany. The admiralty resisted many of Churchill's proposals, fearing that Japan would also join the war and precipitate a triple threat of German, Italian, and Japanese navies. Throughout 1941, tensions in the Pacific drove Australia to request an increased military presence in the Far East, as a deterrent to Japan. The admiralty proposed sending a group of older R-class battleships to the Indian Ocean as a show of force, to be augmented over time by additional warships capable of deterrence. By contrast, Churchill wanted to send a newer capital warship to the region, feeling that a modern vessel would be viewed as the greater deterrent. Churchill won the argument and HMS *Prince of Wales* and HSM *Repulse* were sent to show the flag in the Pacific. Churchill also worked to create partnerships with the United States in the region to discourage Japanese hostilities.¹¹⁸

Japan's preemptive attack on the U.S. Pacific Fleet at Pearl Harbor on December 7, 1941, was meant to destroy, in a single move, the largest credible threat to Japan. Three days after the bombing, Japanese aircraft spotted and sank *Prince of Wales* and *Repulse*, which had abandoned their original mission, off the coast of Malaya.¹¹⁹ The Japanese attack brought the United States into the war as Britain's most important ally.

From April to December 1941, the U-boat fleet expanded from forty-nine to two hundred and fifty.¹²⁰ Whenever possible, Dönitz pushed the U-boats to operating areas in which there was little British resistance, and as the coastal command acquired aircraft with longer ranges, the U-boats moved further west to avoid them, leaving a larger area through which convoys might pass and making it easier to slip by undetected.

The wolf packs had learned to deploy in broad lines across transit lanes to maximize sightings. Dönitz exercised central control over the widely distributed U-boats by broadcasting orders via radio; these transmissions among submarines and command

¹¹⁸ Bell, *Churchill and Sea Power*, 245.

¹¹⁹ Ibid., 248.

¹²⁰ Tarrant, *The U-Boat Offensive*, 97.

headquarters were soon exploited by the British. On May 7, 1941, during a wolf-pack attack on a convoy, the destroyer HMS *Bulldog* captured an Enigma machine from a U-boat forced to the surface, greatly aiding British intelligence in deciphering encrypted messages.¹²¹

Since the beginning of the war, the number of British escorts rose from 180 vessels to nearly 700 by June 1941.¹²² Aircraft and escort vessels began carrying direction-finding equipment that gave the bearings of U-boats transmissions by comparing signals between receiver stations and providing a fix. This technology allowed the British to route convoys away from known U-boat positions and slash merchant-marine losses.¹²³ In November 1941, Britain launched an offensive in Cyrenaica that began to push Rommel out of Africa. In response, Germany pulled eleven U-boats from the Atlantic to the Mediterranean to harass Britain's supply chain, temporarily reducing attacks in the Atlantic. British losses were heavy from April to June, but fell in July, only to spike again in September before slumping below 100,000 tons in December 1941. But America's entry into the war soon presented Germany with other easy targets in the Atlantic.¹²⁴

I. THE WAR UP TO DECEMBER 1941

British shipping took light losses in the first six months of war. Low U-boat numbers, restrictions on commanders, and the rapid execution of convoy policy kept attrition low. Germany's capture of naval ports in Norway and France in 1940, however, allowed U-boats greater penetration into the Atlantic beyond the reach of coastal-command aircraft and convoy escorts, compensating for the low inventory of U-boats. Shipping losses increased from June 1940 to March 1941.¹²⁵ Shorter transits for the U-boats meant greater time in their operating areas, which effectively increased the number of U-boats on patrol at any time. Early attempts at wolf-pack tactics had been limited by

¹²¹ Tarrant, *The U-Boat Offensive*, 98–100.

¹²² *Ibid.*, 100.

¹²³ *Ibid.*, 101.

¹²⁴ *Ibid.*, 102–3.

¹²⁵ *Ibid.*, 94.

a paucity of U-boats, but large-scale construction began delivering U-boats at a rate greater than losses by April 1941.¹²⁶ More U-boats allowed for greater practice of Dönitz's wolf-pack tactics, which in turn led to heavier German reliance on radio transmissions, increasing U-boat vulnerability and allowing the British to avoid encounters. Beginning in May and June, code breakers could decipher German encrypted messages, which further helped the avoidance of wolf packs. But as U-boats began shifting their operating area west, they were able to exploit the gap in escort protection in the north-central Atlantic.

1. The Development of Radar

Aircraft needed a way to locate U-boats in low visibility (poor weather or darkness). British scientists had worked to create a radar set that could detect surfaced U-boats regardless of the time of day or weather conditions, and by late November 1939, trials were conducted on a prototype air-to-surface vessel (ASV) radar. The Mark II ASV radar was the first operational radar that could reliably detect a U-boat beyond visual range. However, as the aircraft flew closer to the scanned object, it would reach the inner limit of the radar's detection ability. Radar helped locate U-boats, but crews still needed daylight and relatively clear weather to attack them once they were visually identified. Poor visibility and darkness still hid U-boats from aircraft equipped with radar.

2. The Leigh Light

The reality that U-boat commanders thrived in darkness compelled the coastal command to find a way to detect them at night. It was not until squadron leader Humphrey de Verde Leigh developed the Leigh light in May 1941 that a solution was found. The Leigh light was a high-powered spotlight mounted on a rotating bracket near the nose of an aircraft, which could be controlled by the air crew. Despite successful test

¹²⁶ Tarrant, *The U-Boat Offensive*, 96.

flights, the invention met bureaucratic opposition and was not installed in operational squadrons until June 1942.¹²⁷

3. Improved Ordnance

Early in the war, coastal command aircraft lacked a way to release the only weapon in its inventory (a 500-pound antisubmarine bomb) effectively. To improve the chances of hitting a U-boat during a pass, four to six bombs needed to be released at regular intervals. The ideal interval was twice the lethal diameter of the bomb plus the width of a U-boat. No British-manufactured aircraft carried a device capable of this delay; in 1939, the only aircraft with both a delay device and the required payload and endurance capability was the Lockheed Hudson, an American aircraft.¹²⁸ Moreover, the 500-pound antisubmarine bomb in question was unreliable. It often failed to detonate and had a tendency to skip when it struck the surface of the ocean—there were instances in which a bomb damaged the aircraft that dropped it after skipping and then detonating in midair. By late 1940, the coastal command had replaced this problematic bomb with a modified 450-pound depth charge that was much more reliable.¹²⁹

4. Britain's Relationship Between the Military and the Scientist

Britain and its allies had a significantly better relationship between the civilian scientific authorities and the military. In 1940, regular informal meetings were held every Sunday between the leading scientist in the nation and top military decision makers. These meetings allowed the military to voice its battlefield needs to scientific and engineering experts who could then look to create solutions. These discussions, called ‘Soviet Sundays’ led to many significant improvements in military technology, Radar chief among them. The relationship between the military and technical experts was not nearly as productive in Germany, where the military more often simply dictated what they wanted rather than a more constructive exchange of ideas.

¹²⁷ Price, *Aircraft Versus Submarine*, 54–7.

¹²⁸ *Ibid.*, 35.

¹²⁹ *Ibid.*, 48.

IV. WINNING THE BATTLE OF THE ATLANTIC

The coastal command, slowly gaining capability in bringing the fight to the U-boat fleet, focused on two primary areas. Its frontline offense put pressure on the submarines as they transited to their operational areas by flying constant patrols over the Bay of Biscay. Three out of four U-boats had to traverse the bay to reach their target area or return for replenishment.¹³⁰ Impeding U-boats in this stretch of water delayed or reduced their operational time in the Atlantic.

The second emphasis was coordination with the navy to provide air cover for Atlantic convoys. The aircrafts' limited range in the vast ocean meant that there were sectors that remained uncovered, despite operating from Allied bases in Canada, Iceland and Greenland. This coverage gap was a significant weakness that U-boats learned to exploit.

A. MAKING UP LOSSES

The number of operational U-boats began to increase after April 1941, which directly boosted shipping losses. Britain had several obstacles to overcome in protecting maritime shipping. ASDIC had proven useless in detecting surfaced submarines, and British forces needed an improved way to detect U-boats beyond visual range in all weather. Once a U-boat was located, British forces needed better armaments with which to damage or disable them. The biggest problem was the lack of escort ships and aircraft with ranges long enough to patrol an entire route across the Atlantic—a casualty of the navy's failure to maintain its antisubmarine technology between the wars and its focus on capital-class warships, rather than the smaller ships more suited to escort duty.¹³¹ Recognizing the need for more escorts, Churchill negotiated with the United States for fifty World War I destroyers, which began arriving towards the end of 1940. By May 1941, thirty of these older warships had entered service with the Royal Navy.¹³² Britain

¹³⁰ Price, *Aircraft Versus Submarine*, 147.

¹³¹ Barnett, *Engage the Enemy More Closely*, 434.

¹³² *Ibid.*, 184.

also sought to replenish the supply of merchant ships available for transporting imports of food and materials. America began supplying “liberty ships” to compensate for the losses that had begun in 1939, but after December 1941, the needs of its own military threatened to diminish the supply intended for Britain.

With the U.S. in the war, Churchill adjusted Britain’s grand strategy. America agreed that, despite the attack at Pearl Harbor and threat in the Pacific, Germany should be the focus of the war effort. With Germany as the Allied priority, Britain became the logical staging point for a major invasion of the continent. Allied leadership on both sides of the Atlantic realized that to defeat Germany, their armies would need to reclaim captured territory. The sea lines of communication had to be maintained for Britain to survive and the U.S. to transport men to Europe. Churchill believed that German morale would be worn down in Russia and that British and American forces could weaken Germany by expelling them from North Africa, the Mediterranean, and the Middle East.¹³³ Increased RAF strategic bombing over Germany would further weaken Axis resolve. Once American forces were staged in Britain, and with Germany weakened and demoralized from the combined efforts of the Allies, Churchill believed an invasive force would be ready to push into Europe by the summer of 1942.¹³⁴

Applying economic pressure on a country that dominated much of Europe called for air power, rather than a naval blockade.¹³⁵ Once Germany declared war on the United States, Dönitz quickly dispatched a small force of U-boats to attack American shipping along the East Coast. America was not prepared for such action. No convoys had been arranged, nor did merchantmen practice evasive actions like zigzagging or darkening the ship at night. However, the damage could have been much worse, as only twelve U-boats were available to attack American shipping in the first quarter of 1942. Hitler had ordered most of the U-boats to the Mediterranean and off the coast of Norway to harass merchantmen supporting the Allied counteroffensive in North Africa. Inexplicably, the

¹³³ Bell, *Churchill and Sea Power*, 255.

¹³⁴ *Ibid.*, 256.

¹³⁵ *Ibid.*, 256.

U.S. Navy, rather than learning from the British example, resisted forming convoys, thinking that merchant ships would be safer sailing independently.¹³⁶

B. THE WAR FOR AIR COVER

In February 1942, the air ministry called for a renewed continental bombing campaign, which Churchill supported. The admiralty disagreed, arguing that the aircraft required should be loaned to coastal command instead, to cut mounting import losses.¹³⁷ A.V. Alexander, Churchill's successor as first lord of the admiralty, informed the defense committee that the navy could not support the RAF's call for a renewed bombing offensive and asked for more very long-range (VLR) aircraft for the coastal command to close the Atlantic air gap.¹³⁸

In the face of air-ministry resistance, Admiral Sir Dudley Pound, commander of the Royal Navy, wrote a memorandum to the defense committee on March 5, stressing the urgent need for greater air support for the navy: "If we lose the war at sea, we lose the war."¹³⁹ He also requested that operational control of the coastal command be shifted to the navy. The air ministry countered that the bomber command could reduce the pressure on shipping by striking naval bases in France and Germany.

The air ministry offered to loan the coastal command a squadron of Whitley bombers immediately and by the end of 1942 provide Catalina flying boats and VLR-capable aircraft. The navy thought this offer inadequate and requested more aircraft for immediate use.¹⁴⁰ Churchill preferred a strong bombing offensive, rather than increased antisubmarine patrols, although shipping losses were a significant problem. When his scientific advisor, Lord Cherwell, predicted that a new navigational aid would enable

¹³⁶ Bell, *Churchill and Sea Power*, 258.

¹³⁷ *Ibid.*, 199.

¹³⁸ *Ibid.*, 258.

¹³⁹ Dudley Pound, Defense Committee Memorandum 23, "Air requirements for the Successful Prosecution of the War at Sea," March 5, 1942. CAB 69/4, cited in Bell, *Churchill and Sea Power*, 259.

¹⁴⁰ Bell, *Churchill and Sea Power*, 260.

bomber squadrons to deliver much more ordnance to German targets, Churchill became less supportive of the navy's request.¹⁴¹

A partial compromise was reached in April 1942, with coastal command receiving four squadrons of non-VLR-capable aircraft from bomber command to be used for Bay of Biscay patrols. The air gap in the Atlantic was neglected, with Alexander continuing to press Churchill for more heavy bombers and Pound and other senior members of the admiralty calling for a reduced bombing campaign and deployment of VLR aircraft to protect merchant shipping. In June 1942, Pound pointed out to the COS that shipping losses had averaged over 677,000 tons from March to May 1942, while the bombing campaign's improved navigational aids had not improved accuracy.¹⁴²

The air ministry fought the navy's call for more aircraft by appealing to Churchill directly. The commander of the bomber command, Air Marshal Sir Arthur Harris, wrote to Churchill in June 1942 claiming that Germany could be forced to surrender in a few months if more resources were applied to bombing. Cherwell, Churchill's scientific advisor, complained that the coastal command was flying fewer missions than it could, given its resources, and argued that before more resources were allocated, it should increase the number of sorties it flew. Churchill was inclined to favor the bomber command, believing that the shipping problem would improve in 1943. He thought that the U.S. would be able to supplement the shipping fleet to offset losses and, in the meantime, was prepared to allow stocks to be depleted to maximize the aircraft available to the bomber command.¹⁴³

Churchill was willing to starve air support to the coastal command and navy because he thought the bombing campaign would be more effective than it actually was and he was depending on America to supply replacement ships. By March 1942, Churchill had explained the need for shipping support to President Roosevelt. Churchill also established a shipping committee to replace the import executive, which specifically

¹⁴¹ Bell, *Churchill and Sea Power*, 261.

¹⁴² *Ibid.*, 263.

¹⁴³ *Ibid.*, 265.

monitored the supply of imports. The shipping committee alerted Churchill that Britain faced a shortage of 8.4 million tons from January–July 1942. If Britain depleted all its reserve stocks, the nation would still face a deficit of over four million tons in this period without additional goods from the Allies.¹⁴⁴ After the war cabinet debated the problem, Churchill explained to Roosevelt that if America could not supply British needs, his country would have to reduce troop and materiel support for joint operations in North Africa and the Mediterranean.

Churchill renewed his resistance to supporting the navy at the expense of the bomber command, this time by circulating a memorandum by Trenchard extolling the virtues of strategic bombing. Pound responded by showing that patrols over the Bay of Biscay were yielding good results, despite that the aircraft and crews loaned by bomber command were not properly equipped for the antisubmarine role, and that more dedicated aircraft and crews would yield even better results. In August, Alexander reported that the coastal command had increased sorties, but the additional flights would cause greater wear and lead on the fewer aircraft that were available for reactionary strikes against U-boats.¹⁴⁵

C. MOUNTING LOSSES IN THE ATLANTIC

Dönitz shifted U-boat operations back to the North Atlantic after America finally adopted convoys, and the German navy began using a different encryption, which suspended Britain's ability to decipher transmissions after February 1942. U-boats continued to exploit the air gap and shipping losses continued to grow. The same month that Britain lost the ability to decipher German codes, the German radio-observation service broke British Naval Cipher No. 3, which let them decipher eighty percent of Atlantic convoy communications.¹⁴⁶ Despite this advantage, U-boats were unable to inflict overwhelming losses—British countermeasures limited the magnitude to around 500,000 tons per month for most of the summer.

¹⁴⁴ Bell, *Churchill and Sea Power*, 266.

¹⁴⁵ *Ibid.*, 267.

¹⁴⁶ Tarrant, *The U-Boat Offensive*, 108.

Several important advances in British antisubmarine warfare (ASW) appeared in 1942. The widespread installation of high-frequency direction-finding (Huff-Duff) equipment on ships and aircraft allowed British forces to triangulate the positions of U-boats, and aircraft, for the first time, were equipped with both radar and Leigh lights, which enabled night attack. In late 1940, scientists had made a major advancement in radar technology, allowing greater detection ranges by using higher frequencies. Mark III sets with this equipment were added to patrol aircraft after 1942. New ordnance also became available, offering better depth settings and reliability, and warships began receiving a new ASW weapon, a forward-firing depth charge called a “hedgehog,” which improved attack abilities. These innovations combined to substantially frustrate U-boat depredations.¹⁴⁷

Germany developed countermeasures to some of these improvements: in September 1942, U-boats were equipped with a radar receiver called a “Metox,” which indicated when radar was transmitting in the vicinity. This warned U-boats of impending attack, allowing them to evade by submerging. Within weeks, U-boats sightings dropped significantly, and by October, only one U-boat was sighted at night in the Bay of Biscay.¹⁴⁸ The Metox was effective until February 1943, when British aircraft, fitted with the new Mark III radar, began transmitting on the ten-centimeter wavelength, beyond Metox detection capacity.

With the invention of the new centimetric-wavelength radar, a debate erupted between the coastal and bomber commands. The bomber command wanted to use the radar’s ground-mapping ability for strategic-bombing missions. Because there was a high probability that a bomber equipped with this device would be shot down over German territory, the coastal command argued that the risk of German scientists’ obtaining the technology was too high and that it should be used for antisubmarine missions instead. Churchill sided with the bomber command and the new radar was flown over enemy

¹⁴⁷ Tarrant, *The U-Boat Offensive*, 109.

¹⁴⁸ Price, *Aircraft Versus Submarine*, 89.

territory in January 1943. The following month, a bomber carrying the new radar was shot down over Rotterdam and coastal command's fear was realized.¹⁴⁹

Although German scientists discovered that the Allies were operating higher-frequency radar, they fumbled in building a receiver that could reliably detect it. By the time Germany produced and installed an updated receiver, British ASW measures had overcome the threat of U-boats. Fortunately for the Allies, German scientists were unable to produce a receiver fast enough to neutralize British radar advantages in the Atlantic.

In June 1942, the coastal command had only five Wellingtons equipped with Leigh lights and Mark III radar sets available for patrols in the Bay of Biscay. In two months, these aircraft sighted eleven U-boats and were able to attack six, destroying one and damaging two. Before this, for the entirety of 1941, only one U-boat had been destroyed by a radar-equipped aircraft. These hits were significant because, until this point, U-boats had remained submerged by day and surfaced by night, when they could move with little fear of detection. The combination of Leigh lights and advanced radar changed the equation for U-boat commanders by denying them the sanctuary of darkness.¹⁵⁰

D. CLOSING THE AIR GAP

Churchill understood in late 1942 that the shipping problem in the Atlantic was becoming critical. He worked hard to get the United States to provide the assets needed to solve the problem, using two approaches. The first recognized that American shipyards were capable of producing new merchant ships much faster than the British produce. He thus sent diplomats to negotiate a firm agreement guaranteeing a supply of new vessels, which he hoped would offset attrition. The second approach was to recognize that British aviation was not producing an aircraft capable of meeting VLR requirements and closing the air gap. Once again, Churchill looked to America to fill the need.

¹⁴⁹ Price, *Aircraft Versus Submarine*, 107.

¹⁵⁰ Ibid., 86.

Churchill fought doggedly to resist any decrease of bomber command's capabilities in favor of the navy and coastal command.¹⁵¹ In the fall of 1942, Dönitz had reassigned U-boats from American shipping to operations in the North Atlantic. Operational U-boat strength in October 1942 climbed to nearly two hundred, and new U-boat construction was exceeding the rate of loss.¹⁵² Under these odds, Allied shipping losses became increasingly heavy. The shipping committee warned the war cabinet in October 1942 that the import problem was acute.¹⁵³

The war cabinet responded by sending Lord Lyttelton to America to secure more merchant ships and escorts. Churchill additionally resurrected the anti-U-boat warfare committee in November 1942. The group quickly saw that the gap in air coverage over the North Atlantic had to be resolved. Churchill, as a chairman of the group, made bomber-command aircraft off limits.¹⁵⁴ The head of coastal command, Sir Philip Joubert de la Ferte, claimed he would need forty VLR aircraft to close the gap.¹⁵⁵

There were two options available. The first was to increase shore-based VLR aircraft, which had the advantage of not requiring protection. However, Britain did not produce any and the available U.S. models needed modification, which delayed delivery by a few months. The second option was coverage from aircraft carriers. The Royal Navy had several carriers at the beginning of the war, and America had shared some of these assets with Britain, but the navy had not used them for escort duty, assigning them instead to the Mediterranean theater. The Royal Navy had begun building smaller carriers for escort, but construction was delayed as they were modified to accommodate expanded capabilities, stalling the implementation of an asset that could have reduced shipping losses. Later, these escort carriers (CVEs) would prove very effective at disrupting U-

¹⁵¹ Bell, *Churchill and Sea Power*, 266–8.

¹⁵² *Ibid.*, 269.

¹⁵³ *Ibid.*, 270.

¹⁵⁴ *Ibid.*, 271.

¹⁵⁵ *Ibid.*, 272.

boat actions. The one disadvantage these ships carried was a need for escort protection when aircraft were not flying.¹⁵⁶

During the summer of 1942, a single squadron of VLR B-24 Liberators finally became available to the coastal command and began covering the mid-Atlantic air gap.¹⁵⁷ Aircraft were increasingly more effective in countering U-boats. Half the U-boats destroyed during the last six months of 1942 were the victims of aircraft and German U-boat losses tripled during the second half of the year.¹⁵⁸ Yet the mid-Atlantic, where U-boats had the greatest freedom to attack, was patrolled by only a single squadron of VLR aircraft.¹⁵⁹

In February 1942, the German navy added another encryption wheel to the Enigma machines carried on U-boats, and British decoders could no longer read German messages. In December 1942, cryptologists at Bletchley Park solved the decryption problem and, for the remainder of the war, could read German transmissions.¹⁶⁰ The following month, Karl Dönitz was promoted to Grossadmiral and assumed command of the entire German navy.

The anti-U-boat-warfare committee decided that thirty-three Liberators used for Biscay patrol would be made VLR capable. To compensate for pulling these aircraft, the coastal command would retain two squadrons of bombers on loan from the bomber command. Churchill acquiesced to this arrangement, although it delayed his plan to build the bomber command to a strength of fifty squadrons.¹⁶¹

E. THE CRITICAL POINT

By November 1942, the shipping problem was near critical and Churchill was forced to begin cuts in munitions production and exports to British colonies. Supplies

¹⁵⁶ Bell, *Churchill and Sea Power*, 272.

¹⁵⁷ Price, *Aircraft Versus Submarine*, 90.

¹⁵⁸ *Ibid.*, 108.

¹⁵⁹ *Ibid.*, 105.

¹⁶⁰ *Ibid.*, 107.

¹⁶¹ Bell, *Churchill and Sea Power*, 273.

shipped to India, for example, were reduced by half.¹⁶² Arrangements had been made with the U.S. to increase ship production and meet Britain's minimum import needs.

By the end of 1942, the coastal command still had only one squadron of VLR aircraft capable of patrolling the mid-Atlantic. In January 1943, the German fielded thirty-seven U-boats in this area, inflicting heavy losses over the next few months,¹⁶³ and at the Casablanca Conference, the combined chiefs of staff agreed to provide eighty VLR aircraft to close the air gap. While heavy losses continued in the first quarter of 1943, the number of VLR aircraft slowly increased.¹⁶⁴ The American military, however, was demanding more resources, which reduced those available for British needs. By late March, President Roosevelt intervened and temporarily reduced supplies to U.S. forces to meet British requirements. He also pushed the USAAF to give another forty-eight VLR aircraft to the Royal Canadian Air Force for patrols of the northwestern Atlantic. By mid-May, the Allies had committed sufficient VLR aircraft to completely cover the Atlantic and close the gap.¹⁶⁵

In March, the first escort carrier to provide air cover for convoys in the mid-Atlantic began operations.¹⁶⁶ During March, two large packs of U-boats aggressively attacked convoys in the Atlantic, but poor weather limited their toll. By March 20, the two packs had sunk twenty-one merchantmen, almost all of them traveling in convoy.¹⁶⁷ U-boat attacks decreased the following month as VLR aircraft increased to thirty and escort carriers were used more frequently. By June, Dönitz had over ninety U-boats in the Atlantic, and with the weather calming down, the U-boat fleet was looking to inflict greater pain.

In March 1943, coastal-command squadrons began flying Biscay patrols with thirty-two Wellingtons equipped with Mark III radars and Leigh lights; the new radars

¹⁶² Bell, *Churchill and Sea Power*, 274.

¹⁶³ Price, *Aircraft Versus Submarine*, 118.

¹⁶⁴ Bell, *Churchill and Sea Power*, 275.

¹⁶⁵ *Ibid.*, 279.

¹⁶⁶ Price, *Aircraft Versus Submarine*, 119.

¹⁶⁷ *Ibid.*, 124.

and increased aircraft were immediately successful. In eight days, patrol aircraft sighted twenty-six U-boats and destroyed one.¹⁶⁸ In April, another eleven U-boats were sighted, with one destroyed. Aware of the new radar, but with no means of detecting it, Dönitz ordered U-boats crossing the Bay of Biscay to remain submerged at night and surface in the day to recharge batteries.¹⁶⁹

June saw another squadron of VLR Liberators assigned to operations in the mid-Atlantic. Coastal-command aircraft had been equipped with a new homing torpedo capable of tracking a submarine moving at high speed for up to three quarters of a mile.¹⁷⁰ Additionally, a second escort carrier and its complement of ASW aircraft became active in the Atlantic. German cipher-breakers were able to provide intelligence on convoy movements, which allowed command headquarters to position U-boats to intercept, but improved air cover thwarted their success. As May and June progressed, British forces were finally able to overcome the U-boat threat. From May to August, the German and Italian navies lost a total of 118 U-boats; of these, seventy-eight were lost by direct action from aircraft.¹⁷¹ From late May to mid-September, no ship crossing the Atlantic was sunk by U-boat.

Bay of Biscay patrols were increased over the summer of 1943. To work around the new radar, Dönitz had ordered U-boats to surface only by day, when they could see approaching aircraft and dive for safety or fire their anti-aircraft guns.¹⁷² British patrols soon realized the U-boats would fight back, and pressed their attacks, rationalizing that the potential loss of an aircraft was less costly to them than the loss of a U-boat to the Germans. By June, Dönitz realized that U-boat counter-aggression was failing and ordered the submarines to cross the bay in packs instead. The coastal command responded with group attacks by aircraft, yielding eleven U-boats sunk and three damaged, at the cost of six aircraft, by the end of July 1943. These tactics continued until

¹⁶⁸ Price, *Aircraft Versus Submarine*, 112.

¹⁶⁹ *Ibid.*, 113.

¹⁷⁰ *Ibid.*, 103.

¹⁷¹ *Ibid.*, 164.

¹⁷² *Ibid.*, 148.

August 2, 1943, when Dönitz ordered U-boats to cross independently, surfacing to recharge only at night. Casualties in the bay up to May 1943 totaled eight U-boats sunk and sixteen damaged. In the proceeding ninety days, twenty-six U-boats were destroyed by aircraft and seventeen damaged.¹⁷³

F. SUCCESS

The Allies had finally found a winning combination of capabilities. First and foremost, the number of VLR aircraft had been increased sufficiently to allow adequate air coverage along entire convoy routes. Escort carriers, in coordination with VLR coastal-command aircraft, provided supplemental air cover where needed. Code breakers at Bletchley Park were quickly and reliably providing intelligence on U-boat pack dispositions, which allowed the coordination of air cover in the hottest areas. Naval warships had become much more lethal to U-boats, with better armaments and improved coordination with naval headquarters through Huff-Duff bearings and current intelligence on enemy positions.¹⁷⁴ By the end of May, U-boat losses in the Atlantic soared to forty-one and Dönitz ordered the withdrawal of U-boats from the North Atlantic.¹⁷⁵

Dönitz believed that the sharp rise in losses was a temporary setback and that after a brief regrouping, the U-boats could return to inflict more damage. He thought that by shifting the fleet to the southern Atlantic, where he expected American convoy protection to be less effective than the British, U-boats could again cause serious damage. However, by June 1943, the U.S. Navy was operating five escort carriers in the region. U-boat losses continued, and from June to September, the ratio of U-boat-to-merchantman destruction plunged to one U-boat for every 1.06 merchant ships.¹⁷⁶ When Dönitz attempted to reassert U-boat attacks in the Atlantic in late 1943, the delay had allowed the Allies to fortify their protections. U-boats could no longer inflict heavy losses and

¹⁷³ Price, *Aircraft Versus Submarine*, 158.

¹⁷⁴ Ibid., 137–8.

¹⁷⁵ Tarrant, *The U-Boat Offensive*, 117.

¹⁷⁶ Ibid., 120.

American shipbuilding was able to exceed U-boat-inflicted losses. Despite improved designs and innovations, Germany was no longer able to threaten British shipping.

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V. CONCLUSION

Great Britain's struggle against Germany U-boats provides a historical example of homeland defense and offers important lessons in recent homeland defense issues. A nontraditional form of war was introduced during World War I—namely, attack on merchant ships with no warning as a means to economically and physically destroy an enemy nation. Britain learned how to cope with this new warfare slowly and painfully, by reverting to a practice that had disappeared before World War I. The convoy system defeated the submarines by concentrating warships in the areas most likely to attract them. Once these convoys were established and adequately protected, the U-boat threat in World War I was neutralized. After WWI, however, the Royal Navy neglected further antisubmarine development, regarding the threat as both distant and sufficiently resolved. When war resumed in 1939, their mistake became immediately apparent.

After WWI, Britain systematically discounted the possibility of a new European war, a view that was reinforced, at least indirectly, by the economic crisis of the 1930s. Germany was able to gain public support for expanding its military despite the restrictions of the armistice, and its decision to rearm, and Britain's hesitation to match its military expansion, ultimately led to a discrepancy in military power between the two nations and left Britain with few options. When Germany began claiming territory by force, Britain responded with a declaration of war despite not having the military wherewithal to confront Germany directly, and was forced to seek allies and employ delaying strategies until its military could gain strength. Britain had learned from World War I that economic warfare could produce results, but required time to wear down the enemy. It had also lost hundreds of thousands of sons and fathers to a stagnant land war and wanted to end the new war at a lesser price. With its military inferior to Germany's, Britain's naval blockade was one of the few options available. The Royal Navy would have preferred a large decisive battle at sea, where it would have enjoyed clear superiority, but German naval leadership understood the disadvantages and avoided major confrontations, relying on submarines to harass merchant shipping instead.

After it became clear that Britain would not compromise, Hitler authorized the resumption of unrestricted U-boat attacks on merchant shipping. He reached this decision more quickly than German leadership had in World War I, but failed to build a U-boat fleet large enough to cause an import crisis. Dönitz had pleaded for a larger fleet and was genuinely surprised when Hitler launched the Polish invasion. From Dönitz's perspective, the German navy, and in particular, the U-boat fleet, was underprepared for war. Hitler had not planned to incite a large-scale war—at least, not immediately. Until Germany conquered territory in Denmark, Norway, and France, Britain's economic blockade could have produced an effect. Once Italy joined the Axis, however, and new territories fell to conquest, the blockade was ineffective in denying resources to Germany.

Hitler did not plan to conduct a war for control of the continent, and although he held an advantage at the war's inception, he had hoped to avoid the consequences of prolonged war with Britain. Germany's tiny force of operational U-boats was unable to pose a viable threat to British imports until production could offset losses and produce a fleet of the size Dönitz requested. Once the fleet approached two-hundred operational U-boats, Britain's imports began to be seriously threatened.

Britain put a tremendous amount of faith in the RAF bomber command's ability to demoralize Germany. The economic constraints placed on the military during the interwar period partly shaped this strategy. The army and navy were short of forces when the war began. The navy had asked for capital ships to replace its aging fleet, but because of a tight economy, could not keep shipyards and large-gun manufacturers operating during the peace. As a result, by the time the British needed warships, they had lost the ability to produce large guns and were constrained to purchase them from overseas.

Royal Navy leadership grossly misunderstood the technological evolution of U-boats during the interwar period, believing convoys and ASDIC would neutralize any U-boat threat. These assumptions led naval leadership to stop building escort ships, leaving far too few ships capable of this role in 1939. Britain came to depend on aid from its allies, especially the United States, which could build merchant ships at higher rates than Britain. America was also able to supply sorely needed raw materials and food to offset losses incurred by U-boats. Once the U.S. entered the war, its navy's assistance in

keeping the sea lines of communication open was a critical step in gaining a foothold in Europe.

Britain's desultory interwar preparation meant that economic blockade and bombing became its only real options. The RAF failed to develop bomber aircraft capable of accomplishing strategic goals; at the beginning of the war, they were too limited in range, payload, and accuracy to drop enough bombs over Germany to destroy morale—furthermore, damage to the collective morale of a nation is difficult, if not impossible, to quantify. By contrast, destroying the industrial capacity to wage war is quantifiable and efficacious; but the poor accuracy of RAF bombers made this objective unattainable until several years after the war began. Depending on the RAF alone to strike from the skies and subdue an entire country was Britain's single largest strategic flaw. Soldiers are the key to controlling territory. Once it became clear that Germany would not relinquish its seized territories, a land force was the only proper tool to liberate the conquered regions and force the occupier to surrender its claims.

Using each of its services and working cooperatively to achieve a grand strategic objective allows a nation to leverage the whole of its military capacity. Adopting a strategy that depends solely on one service or a strategy that relies on a single dimension of warfare is to ignore many crucial factors that must work in combination to achieve victory. Moreover, the prejudicial use of one type of action—in Britain's case, offensive action—over other options, without full measurement of the entirety of a situation, is equally flawed.

Although Germany had a technological advantage early in the conflict and superior land and air forces, these benefits slowly eroded over the course of the war. In the case of the U-boat problem, Britain carefully pursued innovations such as the Leigh light, centimetric airborne radar, Huff-Duff, homing torpedoes, and improved depth-charge launchers to defeat German advances. This was achieved in part by agile coordination between scientists, engineers, industry, and military representatives. Britain established weekly meetings called "Soviet Sundays" where each military branch could explain their outstanding needs to experts in engineering and science.

From these meetings, many decisive technological advances came to fruition. Germany did not have an equivalent environment for presenting military needs. The discovery of the Allied invention of centimetric-wavelength radar is an example of the poor communication between German military and industrial leaders with specific needs and scientists and engineers who might fulfill them. Despite capturing an example of Britain's advanced radar, a responsive detecting device was not installed in the German fleet for almost half a year, by which point Britain had closed the air gap and gained control of the Atlantic.

Many scholars believe that had long-range aircraft been allocated to the coastal command earlier than 1943, the import crisis could have been mitigated before reaching extremis. Price observes that during the winter of 1942 a single mission flown by bomber command frequently lost enough aircraft over Germany to close the air gap over the Atlantic.¹⁷⁷ Winston Churchill scrambled to preserve the number of aircraft available to bomber command and preferred the offensive, seeking to strike at Germany whenever possible, despite information via the Butt report that bombers were hitting targets with less than ten-percent accuracy. As a politician, Churchill had more options than military leadership. He could use desperate circumstances to leverage more support from the Allies or accept cuts in materiel bound for the colonies and rival military branches to preserve the bomber command in which he had invested his confidence.

Although the U-boat struggle in the Atlantic may have been prolonged by Churchill's decisions, he cannot be blamed entirely for the conflict's duration. The navy and coastal command did not push for VLR aircraft to close the Atlantic gap until 1942, and when they did receive capable aircraft, they used them for Bay of Biscay patrol rather than the critical north-central Atlantic. It was Churchill who reinstated the anti-U-boat-warfare committee in November 1942, which quickly identified the Atlantic gap as a root problem. Once this was clarified, aircraft were allocated and the crisis ended; by contrast, the Bay of Biscay patrols were not nearly as productive as closing the air gap. Aircraft over the Atlantic may not have destroyed hundreds of U-boats, but their presence

¹⁷⁷ Price, *Aircraft Versus Submarine*, 138.

deterred attacks and shepherded vital supplies safely to port, while the bay patrols from June–February 1943 accounted for only seven U-boats destroyed in an average of 3,500 flight hours per month.¹⁷⁸ The time and effort spent hunting U-boats transiting to their operating areas would have been better spent deterring attacks in the Atlantic. The decision to fly these bay patrols, and to use precious VLR-capable aircraft for the job, was made, not by Churchill, but by coastal command.

British leadership was in a difficult situation after the summer of 1940. They had narrowly escaped the onslaught of an air campaign that threatened the civilian population. After France fell, the maritime blockade became ineffective and Britain lost its primary ally. The British army was too small to confront Germany directly. Britain's only means of direct engagement was bombing missions against the industrial capacity and morale of the enemy. However, unable to drop enough bombs, or deliver them far and accurately enough to precipitate the desired outcome, Britain to some extent brought about the opposite effect: it hardened the resolve of the people in support of the Führer's will.

Germany had not prepared for a naval campaign against Britain's sea lines of communication. This allowed Britain a small window in which to mitigate the effects of constrictions on its supply chain and incorporate the United States into the war as an ally. Britain needed American industrial capacity, raw materials, and military strength; without these crucial assets, Britain would have lost the Battle of the Atlantic.

Hindsight is always sharper than foresight. The navy, for example, recognized the seriousness of the U-boat threat, but failed to prepare for it or allocate its resources optimally, though convoys were quickly resumed. Churchill might have pulled resources away from the RAF earlier to secure the Atlantic—but the preponderance of information available indicated that losses, although mounting, had not reached a crisis. Churchill was willing to suffer some loss in the Atlantic to maximize grief to Germany through bombing; yet when maritime losses grew critical, he allowed additional VLR aircraft to cover the fatal gap.

¹⁷⁸ Bell, *Churchill and Sea Power*, 282.

In the end, technological advances helped offset British unreadiness and concomitant losses in the Atlantic. But ingenuity would not have been enough. Without the material support the United States brought to the alliance, Britain could not have gained the upper hand.

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